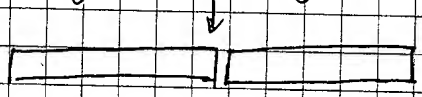
80 Exhibit A

Fusion Splicing

1-5-2000

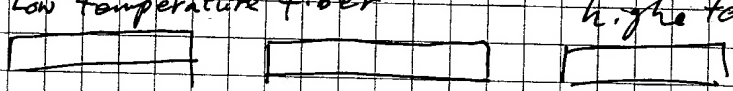
idea: (1) Directly Splicing



change: Splicing time
Splicing currents
Arc Position: The higher the melting point, the closer the Arc.
Try to make the energy distribution asymmetry, higher at closer end lower at far away end!!!

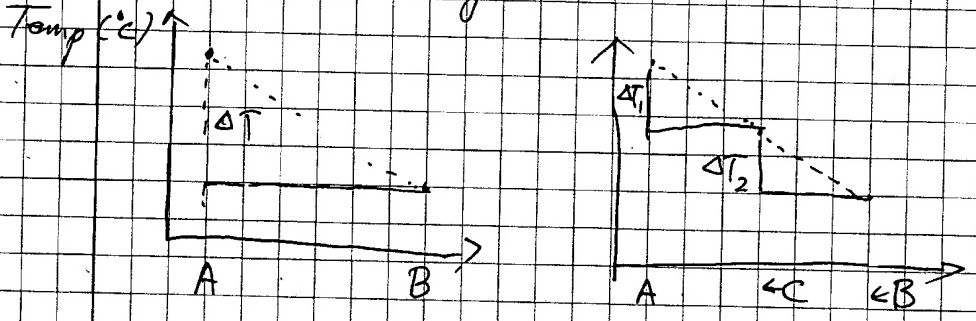
idea position: The arc position is located in where that the temperature in both ends of fibers is nearly to melting points of the fiber. (at least the soften temperat.

idea(2) Immediate



Immediate melting point fiber

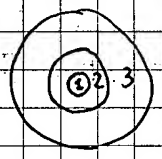
two fiber system



$\Delta T_1 \sim \Delta T_2 \ll \Delta T$

Order { PF1 (ThorLabs)
Ultra-high NA Silica fibers
Coupler Fiber 3M

idea (3) double cladding layer



assume: $D_1 = 6.6\ \mu m$
$D_2 = 30\ \mu m$
$D_3 = 125\ \mu m$

$r_1 = 3.3\ \mu m$
$r_2 = 15\ \mu m$
$r_3 = 62.5\ \mu m$

$$\frac{S_1}{S_3} = \left(\frac{r_1}{r_3}\right)^2 = (0.0528)^2 = 0.00278$$

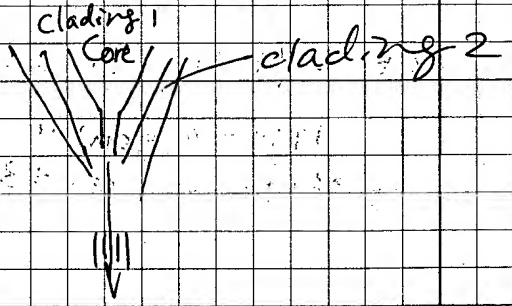
$S_1 \ll 1\%$

$$\frac{S_2}{S_3} = \left(\frac{r_2}{r_3}\right)^2 = (0.24)^2 = 5.76\%$$

if

$$\frac{S_2}{S_3} = 0.20 \qquad \frac{r_2}{r_3} = 0.45$$

$r_2 = 0.45 \times 125 = 56.25$



procedure to produce one fiber
Needed to be developped !!!

S_2/S_3 : 0.40 0.50 0.410

r_2 : 70.2nm 88nm ⇒ 0.80

[redacted] Splice test on [redacted] IF Jan 9, 2001

. SM + SM POL

	Test time	IF	IF	IF	IF	IF
Lose	0.02 dB	IF	-			
Lose	0.03 dB	IF	F			
Lose	0.04 dB	T				
lose	0.01 dB	IF	O			
lose	0.09 dB*	-				
lose	0.05 dB	IF				
Lose	0.11 dB	-	**			

cleved Bad F Dure to the Diamond clever has not move all the way cross.

* lose become 0.04 dB ~~when~~ after refuse

Cut & Refuse F

Failure F

** Left "recut and reuse"

right "new"

=> Refuse 0.33 dB

After electrode clean Program run, The lose estim is much lower, around 0.01 ~ 0.02 dB. Even one sample that recut & re-splice.

Manual Mode Splicing Jan 10, 2001

SM + SM P01

Tatate test time IF

lose	0.01 dB	
Lose	0.02 dB	—
Lose	0.03 dB	F
lose	0.04 dB	
lose	0.05 dB	
lose	0.06 dB	
lose	0.08 dB	+

P[redacted] Change Parameters (Prefuse curr changed)

	P01	P11
Prefuse time	0.2s	0.2s
Prefuse Curr	10.0mA	08.0mA ✓
Gap	50.0μ	50.0μ
overlap	10.0μm	10.0μm
fusion time 1	0.3 s	0.3 s
fusion curr 1	10.5 mA	10.5mA
time 2	2.0 s	2.0 s
Curr 2	16.3 mA	16.3 mA
time3	2.0 s	2.0 s
Curr 3	12.5 mA	12.5 mA
left MFD	9.8 μm	9.8 μm
Right MFD	9.8 μm	9.8 μm
set Center	+255	+255
AOA Curr	0 mA	0 mA
Early prefus	No	No
Align Accura	0.15 μm	0.15 μm
loss shift	0 dB	0 dB
Auto Arc Center	No	No

~~Re-Edit~~

P12 Change Parameter (fusion curr 1)

	P12
prefuse	0.2s
Prefuse curr	8.0 mA
Gap	50 μm
overlap	10 μm
fusion time 1	0.3 s
~~fusion curr~~ 1	8. mA
time 2	2.0 s
Curr 2	16.3 s
time 3	2.0 s
Curr 3	~~16.3 s~~ 12.5 s
Left MFD	9.8 μm
Right MFD	9.8 μm
S.Center	+255
AOA Curr	0 mA
Early Prefus	No

[redacted]205 eccentric S[redacted]+Sm

Total test time IF —

lose	0.01 dB	T
lose	0.02 dB	T
lose	0.03 dB	
lose	0.04 dB	
lose	0.05 dB	T

P11 first programed

total test time F

lose	0.01 dB	T
lose	0.08 dB	—*

P12 changed (fusion curr 1)

total test time IF —

lose	0.05 dB	T
lose	0.04 dB	T
lose	0.06 dB	—
lose	0.01 dB	—

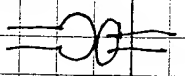
* 0.04 dB refuse

P13 manual Mode

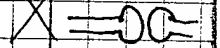
{ Prefuse Curr 3.0 mA ✓
{ Prefuse time 0.3 s

Edit { Prefuse Curr 6. mA temp. too high
{ Prefuse time 0.3s ✗ Matchstick

Edit { Prefuse Curr 4.5mA ✗ Matchstick
{ Prefuse time 0.3 s

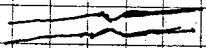


Edit { Prefuse Curr 3.75 mA (3.8 mA) ✗
{ Prefuse time 0.3 S Matchstick



Edit { Prefuse Curr 3.4 mA ✓ No melting
{ Prefuse time 0.3S

Edit { Prefuse Cur 3.6 mA just a little
{ Prefuse time 0.3 S too high



1) fiber cannot be cut by clever.
Mechanical property is poor

2) { Prefuse Current 3.6 mA
{ Prefuse time 0.3 S

Current is very low

P14

Prefuse time	0.25
prefuse Curr	3.4 mA
Gap	50 µm
overlap	10 µA
fusion time 1	0.35
fusion Curren 1	3.85 mA
fusion time 2	2.0 S
fusion Curr 2	3.85 mA
fusion time 3	2.0 S
fusion Curr 3	3.4 mA
Left MFD	9.8 µm
right MFD	9.8 µm
Set center	+255
AoA Curr	0 mA
Early prefuse	NO
Align Accura	0.15 µm
loss shift	0 dB
Auto Arc Center	NO

too high for Erbium Glass. too low for SMF28
The fiber of Erbium Glass is not unifor
in Diameter.

Fibercore glass

DF1500F-980 Erbium Doped Fibre
SD 278A-01A
"c-band" 1530-1560 nm
DF1500L special Erbium-doped Fibre
"L-Band" SD 188B-00E
Concentrate twice as high as DF-1500F
~ 1600 nm

DF1500L

		DF1500F-0980
Fiber Diameter	125 µm	125 µm
NA	0.21	0.24
Cut-off	955 nm	970 nm
Attenuation	25 dB/Km 1200 nm	6.8 dB/Km
Absorption	11.5 dB/m @ 979 nm	4.8 dB/m
	14.6 dB/m @ 1531 nm	6.6 dB/m
Composition	Core Silica/germania	Same as left
	Inner cladding Silica	
Coating	Dual Coat UV Cure Acrylate	
	240 µ Diameter	
Mechanical		
	proof test @ 1% Strain	

Program 01.

manual DF1500L & ~~A~~ SMF-28 fusion splicing

0.09 dB
0.06 dB
0.02 dB

Auto mode
0.07
0.01
0.02

SD278A-01A & SMF-28

0.01 dB
0.03 dB
0.02 dB

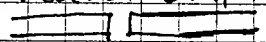
Program 15 a — Jan 16. 200

	15 a	15 b	15 c	
Prefuse time	0.2 S	0.2 S	0.2 S	0.2 S
Prefuse Curr	3.3 mA	3.3 mA	3.0 mA	2.8 mA
GAP	50 μm	50 μm	50 μm	50 μm
Overlap	10 μm	10 μm	10 μm	10 μm
Fusion time1	0.3 S	0.3 S	0.3 S	0.3 S
Fusion Curr	3.3 mA	3.3 mA	3.0 mA	2.8 mA
Fusion time2	1.0 S	0.3 S	0.3 S	0.3 S
Fusion Curr	3.3 mA	3.3 mA	3.0 mA	2.8 mA
Fusion time3	1.0 S	0.3 S	0.3 S	0.3 S
Fusion Curr3	3.3 mA	3.3 mA	3.0 mA	2.8 mA
left MFD	4.8 μm	4.8 μm	←	←
Right MFD	4.8 μm	4.8 μm	←	←
Set Center	+255	+255	←	←
AoA Current	0 mA	0 mA	←	←
Early Prefuse	No	No	←	←
Align Accum	0.15 μm	0.15 μm	←	←
Loss shift	0 dB	0 dB	←	←
Auto Arc Center	no	NO	←	←

← Same as left

Result

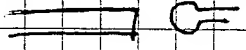
(1) Can not fusion splice two standard SMF-28 Fiber



Same as 15a — Not good ←Same — Cannot stick together

(2) Prefusion cannot clean up SMF-28 Fiber but do melt the phosphate fiber a little.

fusion stage make to phosphate fiber melting and becoming a match-stick.



same as 15a — Not good ←Same — Since phosphate doesn't melt

15 d	15 e	15 f	15 g	15 h
	0.2 S	0.2 S	0.1 S	0.1 S
2.8 mA	2.9 mA	2.9 mA	3.3 mA	3.2 mA
	50 μm	50 μm	50 μm	50 μm
	10 μm	10 μm	10 μm	10 μm
0.3 S	0.3 S	0.6 S	0.1 S	0.1 S
2.8 mA	3.0 mA	2.9 mA	3.3 mA	3.2 mA
1.3 S	1.3 S	1.3 S	1.3 S	1.3 S
2.8 mA	2.9 mA	2.9 mA	2.8 mA	2.8 mA
1.3 S	1.3 S	1.3 S	1.3 S	1.3 S
2.8 mA	2.9 mA	2.9 mA	2.8 mA	2.8 mA
←	←	←		
←	←	←		
←	←	←		
←	←	←		
←	←	←		
←	←	←		
←	←	←		
←	←	←		
NP fiber Did NoT melt !!!	NP fiber D.d melt	melt !!!	Prefuse work fuse ⇒ melt	Prefuse wo fuse mel
Discharged!				